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A COMPARATIVE STUDY ON SOME ROQUETTE GENOTYPES AND THEIR RESPONSE TO PLANTING DATE AND NITROGEN LEVELS

BY

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ABSTRACT

This study was carried out during the winter seasons of 1998-1999 and 1999-2000 at Barrage Research Station (H.R.I., Egypt) to evaluate sixteen genotypes of roquette (*Eruca sativa*) as a first experiment and to evaluate the effect of different sowing dates (15th October and 15th November) and nitrogen levels (0, 40, 60 and 80 kg N/fed) on vegetative growth, fresh yield, chemical composition of plant foliage as well as seed yield quality and the oil percentage of seeds as a second experiment. The results indicated that vegetative growth parameters (plant length, number of leaves/plant, average leaf area and fresh yield/fed.), chlorophyll a,b and carotenoieds, vitamin C, seed yield and the oil percentage were varied among the used strains. Mansoura strain followed by Ismaillia and Zagazig strains gave the best results for all the previously mentioned attributes. On the other hand, the lowest values were recorded by Dokki, Qina and Suhage strains. Although Mansoura strain gave the highest seed germination percentage, it recorded the lowest values for germination rate and the number of seeds/gm. Early planting (15th of Oct.) combined with the highest used level of N (80 kg/fed.) reported the highest values of all studied growth parameters especially in Ismaillia and Mansoura strains compared with Suhage and Aswan strains. On the contrary, nitrate-N content was decreased with early sowing and the lowest level of nitrogen fertilizer.

Key Words: Roquette, Genotypes, Planting date, Nitrogen levels, Growth parameters, Fresh yield, Seed yield, Chemical composition, Oil percentage, Nitrate-N content.

INTRODUCTION

Roquette (*Eruca sativa* L.) is concederd one of the important and popular vegetable crops in Egypt. It is cultivated in winter season for its leaves which are eaten fresh and for its direct seeds that are used to produce roquette oil. Also, roquette is rich in total chlorophyll, Vitamins (A and C), calcium, phosphorus, iodine and iron. So it is very important for man healthy, such as

curing kidney problems, teeth blood, digesing food, the Nicotine posting and preventing the hair drops. So, for Roquette's important benefits many studies were done for improving the rocket strains and increasing the yield. The aim of this study is to evaluate most of the roquette genotypes, which are distributed in different governorates in Egypt. Additionally to studying their response to planting date and nitrogen levels. Many investigators studied the effect of genotypes on vegetative growth, fresh yield, chemical composition of plant leaves and nitrate-accumulation, in addition to the seed yield and its quality in a wide range of vegetable crops including lettuce (Wurr and Fellows, 1984; Kobryn, 1987a and b; Nicoloud *et al.*, 1990; Shafshak and Abo-Sdera 1990), red beet (Peteroniene, 2000), roquette (Maliwal *et al.*, 1984; Kumar *et al.* 1986; Singh and Rajput, 1993 a and b). All of them reported that the cultivars differ greatly in their yield and quality. The best yield of *E. stiva* was obtained at the first harvest and the harvest index was varied between cultivars. Also, they added that there were significant differences among the studied cultivars in plant height, fresh and dry weight per plant as well as in nitrate accumulation. In the same trend, biochemical composition of red beet roots was affected more by cultivars than by cultivation conditions. On the contrary, Ali (1995) recorded no significant differences among the studied lettuce cultivars in chlorophyll a,b and total chlorophyll as well as in carotene content and in nitrate-N accumulation in leaves when the effects of sowing dates and nitrogen levels were studied on lettuce cultivars.

With regard to the effect of sowing date, the previous studies reported that planting date had significant influence on plant characteristics and the seed yield. Also, these studies indicated that early planting of roquette in October produced a higher yield of seeds and oil content compared with the late planting in November. A significant reduction in nitrate-N accumulation was recorded due to the delaying of sowing date (Maliwal *et al.* 1984; Maliwal, 1985; Kumar *et al.* 1986; Sing and Rajput, 1993 a and b). A similar trend for these results was recorded on spinach (Shehata *et al.*, 1990) and on lettuce (Ali, 1995).

Concerning the effect of nitrogen fertilizer, the previous investigations indicated that nitrogen is the main macro-element which is highly effective on growth and yield of leafy vegetable crops such as lettuce, roquette and spinach. It was also found that application of nitrogen fertilizer at the high rates (40 to 80 kg N/fed) to roquette plants significantly increased the plant height, number of leaves/plant, fresh and dry weight of plant, chlorophyll content, total produced fresh yield/fed and the seed yield (Jat *et al.*, 1987; Maliwal and Mundra, 1990 and Salman *et al.* 2000). About the nitrate accumulation, the previous studies proved that application the high levels of nitrogen increased the amount of NO_3 accumulated in the plants of lettuce (Abou-El-Hassan, 1990) and spinach (Shehata *et al.* 1990).

MATERIAL AND METHODS

The present investigation was carried out during the two successive winter seasons of 1998/1999 and 1999/2000 at the Barrage Research Station of the Horticulture Research Institute, Egypt.

The soil of the experimental field was clay loam in texture with pH 7.5 and the conventional practices, i.e. irrigation, and pest control were done as recommended for roquette production.

Two experiments were undertaken to conceive the effect of genotypes of roquette, sowing date and nitrogen fertilizer application on the vegetative growth, fresh yield, seed yield and oil percentage of roquette.

The first experiment was done to evaluate the performance of sixteen different genotypes (strains) of roquette, that were collected from different governorates of Egypt, for their vegetative growth, yield and some economic characters. The second experiment aimed to study the response of the most four promising genotypes of roquette, from a primary experiment to planting dates and nitrogen levels.

First experiment;

In this trial the strains were refferred to be numbered from 1 to 16 as shown in Table 1. Seeds of these strains were sown directly in the field on October 15th in both seasons of study. The area of the experimental plot was 1.0 m^2 that was sown by 1.5 g. of seeds for each genotype. A complete randomized block design with four replicates was adapted.

At the marketable stage, 35 days from sowing, the first cutting was taken. On the other hand the second one was carried out a month later. After that, the plants of each genotype were left to grow under separate screen cage for seeds production (to avoid insect pollination and insure the purity of produce seeds). Mean of the two cuttings was recorded for vegetative growth parameters, chemical composition and total fresh yield of roquette. Also, in this trial, yield, oil percentage and quality of seeds i.e. germination rate, germination percentage and number of seeds per gram were determined.

Table (1): Roquette strains and their sources:

NO	Strains source	No	Strains source
1	**Alexandria.**	9	**Giza (Badrashin).**
2	**Mansoura**	10	**Giza (Aiat).**
3	**Zagazig.**	11	**El Wady-Elgadid.**
4	**Ismailia.**	12	**Elmenia.**
5	**Arish.**	13	**Assiut.**
6	**Tanta.**	14	**Suhage.**
7	**Minofyia.**	15	**Kina.**
8	**Giza (Dokki).**	16	**Aswan.**

Second experiment:

In this trial, four strains of roquette namely Suhage, Aswan, Mansoura and Ismailia were sown at the same place of the first trial. Two planting dates were tested, the first one was on 15th of October and the second one was on 15th of November for both seasons of the study.

Four levels of nitrogen fertilization, i.e. Zero, 40, 60 and 80 kg N/Fed. were applied using Urea, $CO_2(NH_2)_2$, (46.0% N), as a source of nitrogen. The quantities of nitrogen were divided into three equal doses, the first one was applied after two weeks from sowing, the second one was added after the first cutting i.e. 35 days and the third one was added after the second cutting.

In this experiment, a split split plot design with four replicates was adopted. The main plots were used for the distribution of the planting dates, while distribution the sub-plots were used for distribution of genotypes and the sub-sub plots were used for the nitrogen levels.

At the first and second cutting ten plants from each experimental plot were chosen for measuring the following vegetative growth characters i.e., plant length, number of leaves/plant, average leaf area and the fresh weight of plant. Also, total fresh yield (ton/feddan) was recorded. Additionally, the chemical compounds (i.e. photosynthetic pigments and ascorbic acid) were determined as it was described in the official methods of A.O.A.C. (1985). At the first cutting nitrate content was determined according to the method described by Kamal (1951). Foliage of plants from each cutting was oven dried at 70°C to a constant weight, then the dry matter percentage was calculated. Finally, the seed yield was recorded and crude oil content was determined according to the official methods of A.O.A.C. (1970).

All collecting data were subjected to statistical analysis using constant soft program. The least significant differences (L.S.D.) test at 0.05% level of probability was used to determine differences among the compared means of various treatments according to Snedecor and Cochran (1980).

RESULTS AND DISCUSSION

First Experiment:

Evaluation of some roquette strains for vegetative growth, yield and some economic characters:

Data presented in Table 2 showed that there were significant differences among the studied strains in plant length, number of leaves per plant and the average leaf area in the both seasons. In this regard, Mansoura strain followed by Ismailia, Zagazig and Aswan strains showed the highest values for all the previously mentioned growth attributes in both seasons. On the contrary, Kina, Dokki, Elwady-Elgadid and Assiut reflected the lowest values for all studied vegetative growth parameters.

Concerning the effect of genotypes on plant weight and total fresh yield per feddan, data presented in the same Table show cleary that there were significant differences between the different studies strains. In this regard, Mansoura strain ranked the first during both seasons followed by Ismailia, Minofya and Aswan Strains. On the other hand, Suhage and Kina strains showed the least values for plant weight and total fresh yield per feddan during both seasons of study. Moreover, the highest total fresh yield, produced by Mansoura,

Ismailia, Zagazig, Aswan and Minofyia strains, was connected with the highest vegetative growth of plant expressed as plant fresh weight which consequently affected total produced yield per feddan. These results agree with Yadav and Kumar (1984) who found that harvest index of *E. sativa* was varied between cultivars. Also in this regard, Wurr and Fellows (1984) studied the growth of three crisp lettuce cvs. and they noticed that there were variations between cultivars in growth and fresh yield.

Table (2): Effect of some roquette genotypes on vegetative growth and total fresh yield in 1998 / 1999 and 1999 / 2000 winter seasons.

Genotypes	Season 1998/1999				
	Plant length (cm.)	No.of leaves/ plant	Average leaf area ($cm.^2$)	Plant weight (g.)	Total fresh yield (ton/fed.)
Mansoura	30.2	12.3	96.1	10.6	7.733
Dokki	23.3	10.7	74.7	9.2	6.333
Assiut	24.6	10.6	74.2	8.7	6.212
Elmenia	24.6	10.7	73.3	8.6	6.201
Zagazig	28.5	11.5	82.5	10.5	6.981
Alexanderia	24.6	10.0	71.8	8.5	6.967
Ismailia	28.8	12.0	83.5	10.5	7.667
El wady-Elgadid	24.5	9.3	68.5	8.3	5.401
Giza (Aiat)	28.0	11.3	80.3	9.6	6.567
Minofyia	28.1	11.3	80.5	9.7	6.733
Arish	24.6	10.8	61.0	7.3	5.333
Kina	24.1	10.2	69.8	7.0	5.267
Aswan	28.3	11.3	80.8	9.8	6.933
Suhage	28.0	10.7	60.6	6.9	4.887
Giza (Badrashin)	27.7	10.9	73.5	9.5	6.367
Tanta	27.8	11.0	80.2	9.6	6.401
L.S.D.at 0.05	2.9	N.S.	15.6	1.6	0.794
Season 1999/2000					
Mansoura	29.7	12.1	88.5	10.0	7.833
Dokki	25.3	10.2	73.3	8.8	6.867
Assiut	25.1	10.0	72.7	8.1	6.801
Elmenia	26.6	10.0	69.2	7.8	6.733
Zagazig	26.9	11.3	81.3	9.5	7.365
Alexanderia	23.8	10.0	68.7	7.3	6.401
Ismailia	29.1	11.5	82.5	9.8	7.401
El wady-Elgadid	23.8	10.0	67.3	7.6	6.333
Giza (Aiat)	26.1	10.8	76.3	8.8	7.201
Minofyia	26.1	10.8	80.3	9.2	7.233
Arish	26.8	9.7	66.0	6.1	6.201
Kina	25.3	9.7	78.8	5.8	6.001
Aswan	26.1	10.8	59.0	9.3	7.201
Suhage	25.3	9.7	49.8	5.6	5.801
Giza (Badrashin)	25.8	10.2	73.5	8.3	7.001
Tanta	26.1	10.5	74.7	8.5	7.133
L.S.D.at 0.05	1.2	1.3	14.2	1.7	0.673

Concerning the effect of roquette genotypes on photosynthetic pigments, i.e., chlorophyll a,b and carotenoids content, data in Table 3 show clearly that there were differences in photosynthetic pigments content among the studied strains. Such differences reach the level of 0.05 significance in case of chlorophyll a and carotenoids only during the second season. In this concern, the highest values for chlorophyll a and carotenoides content were recorded in case of Suhage and Mansoura strains, respectively.

Table (3): Effect of some roquette genotypes on photosynthetic pigments and vitamin C content (mg/100g fresh weight of leaves).

Genotypes	Season 1998/1999				Season 1999/2000			
	Chlorophyll		Carote-noides	Vitamine C	Chlorophyll		Carote-noides	Vitamine C
	a	b			a	b		
Mansoura	25.0	6.0	65.0	114.0	26.0	7.0	63.0	109.0
Dokki	22.0	6.0	62.0	103.0	22.0	6.0	60.0	101.0
Assiut	18.0	6.0	59.0	102.0	19.0	6.0	58.0	101.0
Elmenia	18.0	6.0	62.0	102.0	18.0	7.0	61.0	101.0
Zagazig	19.0	6.0	58.0	107.0	18.0	6.0	58.0	106.0
Alexanderia	16.0	6.0	59.0	101.0	19.0	6.0	58.0	100.0
Ismailia	20.0	7.0	56.0	112.0	25.0	6.0	54.0	108.0
El wady-Elgadid	22.0	6.0	54.0	100.0	20.0	6.0	46.0	99.0
Giza (Aiat)	20.0	6.0	61.0	106.0	21.0	6.0	60.0	104.0
Minofyia	20.0	6.0	60.0	108.0	19.0	6.0	61.0	107.0
Arish	19.0	6.0	60.0	100.0	21.0	7.0	60.0	98.0
Kina	20.0	6.0	48.0	97.0	18.0	6.0	47.0	96.0
Aswan	18.0	6.0	62.0	107.0	22.0	6.0	62.0	105.0
Suhage	26.0	6.0	72.0	91.0	27.0	7.0	73.0	94.0
Giza (Badrashin)	17.0	5.0	63.0	103.0	22.0	7.0	62.0	102.0
Tanta	19.0	6.0	58.0	105.0	24.0	6.0	56.0	102.0
L.S.D.at 0.05	N.S.	N.S.	N.S.	10.0	6.0	N.S.	12.0	6.0

With regard to the effect of genotypes on Vitamin C content, data in Table 3 indicate also that the studied strains were significantly differed in their content of Vitamin C in both seasons of study. In this respect, the highest values of Vitamin C content were recorded in case of Mansoura strain in both seasons followed by Ismailia and Minofyia strains, respectively. On the other hand, the lowest values were recorded in case of Suhage, Kina and Arish Strains, respectively. These results are similar to those obtained by Hassani *et al.* (1987) on cauliflower and Shehata *et al.* (1990) on spinach, who revealed that chlorophyll a,b and total carotene in addition to Vitamin C conent were varied between cultivars and significantly increased with early cultivars.

With regard to the effect of genotypes on seed yield and oil percentage, data in Table 4 indicate that there were significant differences between the studied strains during the two seasons. In this regard, the highest values of seed yield per Feddan and oil percentage were recorded in Mansoura Ismailia and Zagazig strains, respectively in both seasons. The superiority of the previously

strains in seed yield production may be due to the superiority of such strains in their vegetative growth (Table 2). Moreover, the highest seed oil percentage of such strains was positively related to the higher seed yield product for such strains. On the contrary, Suhage and Alexandria Strains recorded the least values for seed yield and,oil percentage in both seasons. These results confirm those obtained by Maliwal (1985) and Maliwal and Mundra (1990) who found that seed yield of *Eruca sativa* varied beween the cultivars under the study. Also, data presented in Table 4 show the effect of different studied genotypes of roquette on seeds quality expressed as number of seeds/gram, germination percentage and germination rate. Such data indicate that there were significant differences among the studied strains in all aforementioned seeds quality attributes. In this regard, the lowest number of seeds/g was noticed in Aswan strain, whereas the highest values for germination percentage and germination rate were recorded in Mansoura and Ismailia Strains, respectively in both seasons of study.

Finally it can be concluded that the strains Mansoura Ismailia and Zagazig can be recommended for fresh yield and seed yield, in addition to, the strains Mansoura Tanta and Aswan for seed oil production as well as Aswan and Suhage strains for the seed quality (Percentage and rate of germination).

Second Experiment:

Effect of planting dates and nitrogen levels on vegetative growth, yield and some economic characters of roquette:

Concerning the effect of sowing date, data in Table 5 revealed that there were significant differences in all studied characteristics due to planting date in both seasons. In this respect, early planting, i.e., sowing of seeds on 15th October reflected the highest values in all studied growth parameters as well as the total fresh yield. Contra results were obtained due to late planting. Such results may be attributed to the environmental condition which increased the photosynthetic pigments content which connected with higher assimilation rate and consequently increased the vegetative growth of the plant and finally increased the total fresh yield of roquett. Obtained results are agreement with those reported by Wurr and Fellows (1984) on crisp lettuce, Ali (1995) on some lettuce cvs. and Peteronicne (2000) on some red beet and roquette cvs.

Regarding the effect of genotypes, the same data at Table 5 show clearly that there were significant differences among the studied cultivars in growth parameters and total green yield during both seasons of study. In this regard, Ismilia strain ranked first and reflected the highest values in all studied characters during the two cuttings in both seasons, followed by Mansoura and Suhage strains. On the other hand, Aswan strain reflected the lowest values. Obtained results may due to the genetic potentiality of such strains and its adaptation to the biological condition of the experimental field. Such results are in conformity with those reported by Yadav and Kumar (1984) on roquette, Wurr and Fellows (1984), Kobryn (1987b) and Nicoloud *et al.* (1990) on lettuce, Shehata *et al.* (1990) on spinach and Nomura *et al.* (1999) on radish.

Table (4): Effect of some roquette genotypes on yield, oil percentage and quality of seeds during 1998/1999 and 1999/2000 seasons.

Genotypes	Season 1998/1999				
	Seed yield (Kg/Fed.)	Oil %	Germination		No.of seeds/ gram
			%	Rate	
Mansoura	365.67	29.6	97.0	1.71	484.0
Dokki	253.33	23.3	93.0	1.91	505.0
Assiut	253.06	26.0	93.0	1.70	542.0
Elmenia	252.80	25.0	92.0	1.57	556.0
Zagazig	353.86	26.7	96.0	1.63	479.0
Alexanderia	217.33	23.0	90.0	1.72	510.0
Ismailia	360.53	27.6	93.0	1.55	498.0
El wady-Elgadid	270.53	26.3	93.0	1.81	583.0
Giza (Aiat)	287.20	23.6	91.0	1.82	477.0
Minofyia	279.73	26.7	90.0	1.88	495.0
Arish	246.26	23.6	92.0	1.74	573.0
Kina	235.00	25.3	96.0	1.72	555.0
Aswan	273.33	26.3	94.0	1.73	474.0
Suhage	214.00	21.6	96.0	1.68	514.0
Giza (Badrashin)	285.33	25.6	96.0	1.59	500.0
Tanta	277.90	26.3	96.0	1.69	521.0
L.S.D.at 0.05	30.88	1.4	0.56	0.01	20.82
Season 1999/2000					
Mansoura	360.10	28.8	97.6	1.63	490.0
Dokki	288.00	23.6	95.0	1.76	573.0
Assiut	282.93	26.0	90.0	1.56	508.0
Elmenia	246.13	25.1	90.0	1.69	515.0
Zagazig	346.93	27.1	93.0	1.57	520.0
Alexanderia	238.73	21.3	91.0	1.69	580.0
Ismailia	352.93	28.0	90.0	1.50	525.0
El wady-Elgadid	292.93	24.3	91.0	1.69	476.0
Giza (Aiat)	305.60	21.8	89.0	1.68	569.0
Minofyia	317.86	23.0	90.0	1.73	531.0
Arish	274.83	25.6	92.0	1.63	476.0
Kina	258.40	24.3	87.0	1.68	525.0
Aswan	311.86	24.6	83.0	1.62	459.0
Suhage	233.06	20.0	94.0	1.68	495.0
Giza (Badrashin)	288.00	26.1	91.0	1.73	500.0
Tanta	279.33	26.0	97.0	1.69	488.0
L.S.D.at 0.05	11.01	0.4	0.92	0.01	21.91

As for the effect of nitrogen fertilization levels, data at the same table indicate that increasing nitrogen level from 0 up to the highest used level (80 kg N/fed.) significantly increased all the studied morphological characters of the plant and total fresh yield for the two cuttings in both seasons. Such increment effect of nitrogen, may be due to the main role of nitrogen as a macro nutrient and essential element and its effect on the cell division and cell elongation and

Table 5: Effect of sowing date, genotypes and nitrogen levels on vegetative growth and total fresh yield of roquette in 1998/1999 and 1999/2000 seasons.

Treatments			Season 1998/1999					Season 1999/2000				
			Plant length (cm.)	No.of Leaves/ plant	Leaf area (cm^2)	Plant weight (g.)	Fresh yield (ton/fed.)	Plant length (cm.)	No.of Leaves/ plant	Leaf area (cm^2)	Plant weight (g.)	Fresh yield (ton/fed.)
First cutting	S. dates	Oct.15th	28.5	11.5	65.6	14.3	7.125	25.4	10.1	72.5	14.7	7.027
		Nov.15th	23.6	8.7	54.2	12.2	5.731	22.1	8.1	58.1	11.6	5.935
		L.S.D at 0.05	0.3	0.4	2.7	4.9	0.373	0.3	0.3	10.1	1.6	0.210
	Genotypes	Suhage	25.9	9.0	58.1	12.4	6.492	23.5	9.1	68.1	14.6	6.508
		Mansoura	26.4	10.0	60.5	12.1	6.658	24.5	9.2	63.4	13.3	6.558
		Ismailia	27.2	10.0	64.8	14.1	6.846	24.5	9.3	68.1	15.5	6.683
		Aswan	24.4	9.0	56.5	11.6	5.717	22.5	8.7	61.7	9.3	6.175
		L.S.D at 0.05	1.3	0.6	1.6	2.9	0.179	0.6	0.6	4.0	1.3	0.240
	N. Levels	0	17.1	8.0	47.1	6.5	4.333	18.7	5.4	51.1	4.8	4.208
		40	24.6	10.0	57.9	9.8	5.817	23.4	8.2	66.1	9.6	6.051
		60	29.4	12.0	63.8	13.9	7.238	25.5	10.3	68.1	13.6	7.451
		80	33.1	15.0	70.7	23.0	8.325	27.5	12.2	76.5	24.6	8.217
		L.S.D.at 0.05	0.9	0.7	1.7	2.2	0.312	0.4	0.4	3.9	1.3	0.290
Second cutting	S. dates	Oct. 15th	25.8	24.3	66.9	38.6	6.585	25.3	18.2	69.5	35.5	6.173
		Nov. 15th	21.9	18.3	54.9	31.8	5.715	22.1	14.2	55.8	29.1	5.498
		L.S.D. at 0.05	0.4	0.3	2.6	7.5	0.223	1.6	1.1	3.3	1.0	0.001
	Genotypes	Suhage	21.9	20.0	61.1	31.1	5.842	23.5	17.3	61.1	29.1	5.917
		Mansoura	24.6	23.0	61.9	32.9	6.279	24.1	17.3	60.9	32.1	5.821
		Ismailia	27.3	24.0	62.4	46.6	6.683	24.7	17.5	68.2	43.1	5.896
		Aswan	21.4	18.2	58.1	30.1	5.796	22.5	12.9	60.6	25.1	5.708
		L.S.D.at 0.05	0.8	1.3	2.2	2.0	0.288	0.8	0.7	3.1	1.3	0.165
	N. Levels	0	18.6	9.7	44.5	14.3	3.901	18.2	9.5	47.3	14.1	3.708
		40	23.3	15.9	58.5	29.1	5.689	23.1	13.8	61.5	27.1	5.367
		60	24.9	27.9	65.5	39.6	7.267	25.6	18.7	66.9	37.1	6.767
		80	28.3	32.0	75.5	57.8	7.775	28.1	23.2	74.9	50.5	7.501
		L.S.D.at 0.05	0.7	0.8	2.3	2.2	0.372	0.7	0.6	4.2	1.5	0.538

Table 6: Effect of sowing date, genotypes and nitrogen levels on photosynthetic pigments, vitamin C (mg/100g fresh weight of leaves)and dry matter % of roquette.

Treatments			Season 1998/1999					Season 1999/2000				
			Chlorophyll		Carotin-oides	Vitamine c	Dry matter (%)	Chlorophyll		Carotinoides	Vitamine C	Dry matt (%
			a	b				a	b			
First cutting	S. dates	Oct.15th	24.0	7.0	69.0	104.0	11.7	23.0	7.0	70.0	102.0	11.5
		Nov.15th	21.0	6.0	62.0	97.0	10.7	20.0	6.0	62.0	96.0	11.(
		L.S.D at 0.05	0.7	0.2	1.9	0.7	1.1	0.6	0.6	1.1	0.8	0.3
	Genotypes	Suhage	23.3	7.5	68.0	92.0	10.7	23.0	7.3	70.0	96.0	10.9
		Mansoura	23.0	7.0	67.0	100.0	10.7	22.0	7.0	68.0	98.0	10.7
		Ismailia	22.0	7.0	65.0	101.0	11.4	21.0	6.5	66.0	97.0	10.9
		Aswan	22.0	6.0	62.0	108.0	11.9	21.0	6.0	61.0	106.0	11.7
		L.S.D.at 0.05	0.6	N.S.	1.6	1.9	0.6	0.6	0.3	0.8	2.8	0.5
	N. Levels	0	17.0	5.0	75.0	85.0	8.4	16.0	5.0	76.0	81.0	7.9
		40	22.0	6.0	69.0	100.0	10.7	21.0	6.0	69.0	97.0	10.4
		60	24.0	8.0	65.0	119.0	12.3	24.0	8.0	65.0	119.0	12.5
		80	27.0	9.0	54.0	99.0	13.3	26.0	9.0	55.0	101.0	13.5
		L.S.D.at. 0.05	0.4	0.2	0.4	2.3	0.5	0.5	0.3	1.1	2.0	0.4
Second cutting	S. dates	Oct. 15th	26.0	8.0	74.0	108.0	12.3	25.0	8.0	72.0	101.0	12.8
		Nov. 15th	22.0	7.0	66.0	100.0	12.0	22.0	7.0	64.0	100.0	12.3
		L.S.D. at 0.05	0.6	0.7	2.0	7.0	0.1	0.4	0.2	0.8	1.6	0.5
	Genotypes	Suhage	24.0	8.5	73.0	101.0	12.5	24.0	8.5	72.0	100.0	12.2
		Mansoura	23.0	8.0	70.0	102.0	12.3	23.6	8.0	70.0	100.0	12.3
		Ismailia	22.5	7.6	67.0	107.0	12.5	23.0	7.2	64.0	96.0	12.6
		Aswan	22.3	7.0	68.0	107.5	13.1	23.0	7.0	66.0	106.0	12.7
		L.S.D.at 0.05	0.4	0.2	1.9	2.9	0.5	0.6	0.3	1.0	2.6	0.3
	N. Levels	0	9.0	5.0	81.0	88.0	9.9	18.0	6.0	79.0	82.0	10.1
		40	23.0	6.0	71.0	106.0	12.3	23.0	7.0	71.0	99.0	11.8
		60	25.0	8.0	67.0	121.0	13.5	25.0	8.0	66.0	121.0	13.4
		80	28.0	9.0	61.0	112.0	14.7	28.0	10.0	56.0	99.0	14.6
		L.S.D.at 0.05	0.5	0.2	1.2	3.0	0.3	0.4	0.3	1.2	2.0	0.3

consequently increased the vegetative growth of plant as well as the produced yield. Obtained data are confirmed with those reported by Trembalay and Senecal (1988), Eid and Abo-Sedera (1989) and Shafshak and Abo-Sedera (1990) on lettuce who found that the shoot growth and total yield of lettuce were enhanced at the higher rate of nitrogen. Also, the same result was obtained by Salman *et al.* (2000) on roquette.

Data presented in Table 6 clearly reveal that the photosynthetic pigments of roquette leaves (chlorophyll a,b and carotenoids), Vitamin C content and dry matter % were significantly affected by sowing date. In this regard, early sowing, i.e. on 15th of October significantly increased all assayed photosynthetic pigments, Vitamin C and dry matter % compared with the late sowing on 15th of November during the both seasons of study. The increments in the previous characteristic during early planting may be due to the suitable and prevailing temperature during early sowing which affect on nutrient absorption especially nitrogen element which is essential molecules for photosynthetic formation and vegetative growth. Similar results were recorded by Gurvinderjit *et al.* (1985) on roquette, Shehata *et al.* (1990) on spinach and Ali (1995) on lettuce. With regard to the effect of genotypes, data in the same Table indicate that Suhage strain, reflected the highest photosynthetic pigments content during the both seasons followed by Mansoura which was significantly differed from Ismailia and Aswan Strains. On the other hand, Aswan Strain recorded the highest values for Vitamin C content and the percentage of dry matter. Such differences between the studied strains may be due to the differences in photogenic variance among such strains. Similar results were reported by Petroniene (2000) on roquette, Shehata *et al.* (1990) on spinach and Ali (1995) on lettuce.

As for the effect of nitrogen fertilizer levels, also, data in Table 6 indicate that chlorophyll a and b as well as dry matter % were steadily and significantly increased with increasing nitrogen level from 0 up to 80kg N/fed.

Regarding, Vitamin C, the highest value was obtained due to the application of 60 kg N/fed. Such stimulative effect of nitrogen fertilizer may attributed to the main role of nitrogen element as a constituent of such attributes. On the contrary, carotenoides content were decreased as nitrogen level increased. Similar trend was noticed during the two cuttings in both seasons of study. These results are in conformity with those reported by Salman *et al.* (2000) on roquette and on lettuce by Eid and Abo-Sedera (1989) and Shafshak and Abo-Sedera (1990).

Concerning the effect of sowing date, genotypes and nitrogen levels on leaf content of nitrate, seed yield and oil percentage of roquette seeds, data recorded in Table 7 indicate that the sowing date significantly affected all the above mentioned measurements during the two seasons of study. In this regard, delaying sowing date from 15th of October to 15th of November negatively affected seed yield and oil percentage and positively affected on NO_3-N content. Obtained results take the same trend during the both seasons of study. The increase in the seed yield and oil % and the decrease in NO_3-N content which

occur in early planting may be attributed to the effect of prevailing temperature and length of photoperiod per day during the early planting on flowering of roquette which consequently affected seed yield and the seed oil %, additionally, to the effect of the previous environmental factors on nitrate reductase enzyme activity which consequently affects nitrate accumulation in plant Foliage. These results were agree with those reported by Shehata *et al.* (1990) on spinach who revealed that the nitrate accumulation was significantly decreased with early planting.

Table (7): Effect of sowing date, genotypes and nitrogen levels on nitrate content (mg/100g dry weight of leaves), seed yield and oil percentage of roquette seeds in 1998/1999 and 1999/2000 seasons.

Treatment		Season 1998/1999			Season 1999/2000		
		Nitrate content	Seed yield (Kg/Fed.)	Oil %	Nitrate content	Seed yield (Kg/Fed.)	Oil %
S. dates	Oct. 15th	171.5	250.91	26.31	171.9	234.09	26.7
	Nov. 15th	186.1	218.27	24.19	192.9	209.21	24.1
	L.S.D. at 0.05	0.3	18.02	0.84	0.9	6.81	0.63
Genotypes	Suhage	178.9	246.16	24.3	187.8	222.75	24.9
	Mansoura	180.5	263.91	24.5	192.8	258.37	25.9
	Ismailia	176.5	259.01	25.1	172.1	235.87	23.9
	Aswan	179.5	169.29	26.9	177.6	169.59	26.8
	L.S.D. at 0.05	2.0	10.35	0.37	1.2	15.07	0.71
N. Levels kg/fed.	0	125.6	138.71	18.1	132.3	141.01	18.6
	40	166.6	212.95	23.2	172.8	195.62	24.3
	60	194.7	269.79	28.3	196.8	253.83	28.1
	80	228.6	316.91	31.3	227.8	297.12	30.5
	L.S.D. at 0.05	2.5	9.61	0.35	1.4	12.28	0.64

Regarding to the effect of genotypes, data presented in the same table indicated that the used strains were significantly differed in all the above mentioned measurements in both seasons. In this respect, Ismailia strain show least value of nitrate accumulation. On the other hand, Mansoura strain reflected the highest value in this regard, and it also, produced the highest values of seed yield during the both seasons. However, Aswan strain reflected the highest seed oil %. Obtained results may be due to the differences between strains in flowering dates which consequently reflected on seed yield and its quality. These results are agreement with those reported by Maliwal *et al.* (1984), Kumar *et al.* (1986) and Singh and Rajput (1993 a and b) on *Eruca sativa*.

As for the effect of nitrogen fertilizer on nitrate content, seed yield and oil percentage, also, data in Table 7 show clearly that all the previous parameters were significantly increased with increasing nitrogen level from 0 up to 80 kg N/fed. The highest values in all previous mentioned attributes were recorded when nitrogen was applied at the level of 80 kg N/fed. Whereas the lowest value was recorded in case of the control treatment, i.e. 0 kg N/fed.. Such trend was obtained during the both seasons of study. Such increment was expected due to

the main role of nitrogen element as a constituent of such attributes. Also, obtained results are connected with the effect of nitrogen on vegetative growth and total fresh yield, (Table 5) which reflected on the seed yield and oil content. These results are agreement with those reported by Maliwal *et al.* (1984) and Kumar *et al.* (1986) on *Eruca sativa*.

Finally it could be concluded that under similar conditions, early sowing on 15th of October for Ismailia and Mansoura strains combined with the addition of nitrogen fertilizer at 80 kg N/fed. are recommended for highest fresh yield/fed. Morcover, Mansoura strain followed by Ismailia at early planting and addition of 80 kg N/fed. are recommend for higher seed yield production with best quality.

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دراسة مقارنة على بعض سلالات الجرجير ومدى إستجابتها لمواعيد الزراعة ومستويات التسميد النيتروجينى

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أجريت هذه الدراسة خلال المواسم الشتوية للسنوات ١٩٩٨-١٩٩٩، ١٩٩٩-٢٠٠٠ فى محطة التجارب الزراعية بالقناطر الخيرية التابعة لمركز البحوث الزراعية بالجيزة لتقييم ١٦ سلالة من الجرجير كتجربة أولى وأيضا إلى دراسة تأثير مواعيد الزراعة (١٥ أكتوبر و ١٥ نوفمبر) ومستويات التسميد النيتروجينى (صفر، ٤٠، ٦٠، ٨٠ كجم نيتروجين/فدان) على النمو الخضرى والمحصول الطازج والتركيب الكيماوى بالاضافة إلى محصول البذور ونسبة الزيت فى البذور كتجربة ثانية.

ولقد أكدت النتائج أن قياسات النمو الخضرى (طول النبات، عدد الأوراق للنبات، متوسط مساحة الورقة والمحصول الطازج للفدان) وكذلك كلورفيل (أ،ب) والكاروتينات وفيتامين ج ومحصول البذور ونسبة الزيت فى الجذور قد اختلفت تبعا لاختلاف السلالات محل الدراسة. كما اتضح من الدراسة أن سلالة المنصورة يليها سلالات الاسماعيلية والزقازيق قد أعطت أفضل النتائج لكل الصفات المدروسة. وعلى العكس من ذلك فإن سلالات الدقى وقنا وسوهاج اظهرت أقل النتائج. وبالرغم من أن سلالة المنصورة كانت الأعلى فى نسبة إنبات بذورها إلا أنها أبدت أقل القيم بالنسبة لسرعة إنباتها وكذلك متوسط عدد البذور للجرام الواحد.

أتضح أيضا من الدراسة أن الزراعة المبكرة (منتصف اكتوبر) مع استخدام المستوى العالى من التسميد النيتروجينى (٨٠ كجم/نيتروجين/فدان) قد أعطت أعلى القيم بالنسبة لجميع الصفات المدروسة خصوصا مع سلالات الاسماعيلية والمنصورة مقارنة بسلالات سوهاج وأسوان. وعلى النقيض من ذلك فإن محتوى النيتروجين النتراتى قد تراجع أو قل مع الزراعة المبكرة وعدم الإسراف فى التسميد النيتروجينى.